INDUSTRIALES RESEARCH MEETING 16

ECONOMIC VALUATION OF TRAFFIC NOISE BASED ON ARTIFICIAL NEURAL NETWORKS

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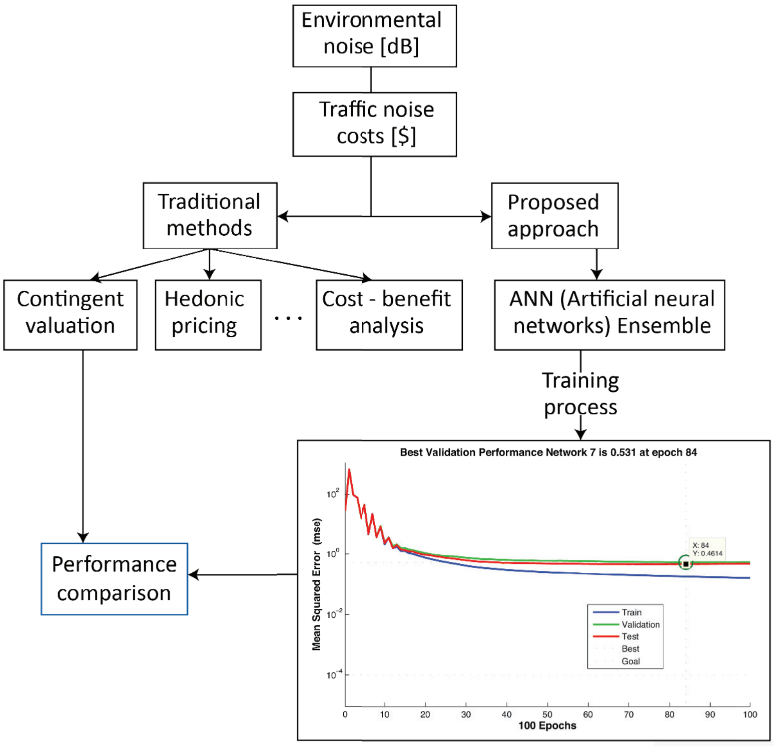
GRUPO DE INVESTIGACIÓN EN INSTRUMENTACIÓN Y ACÚSTICA APLICADA

INGENIERÍA EN SONIDO Y ACÚSTICA

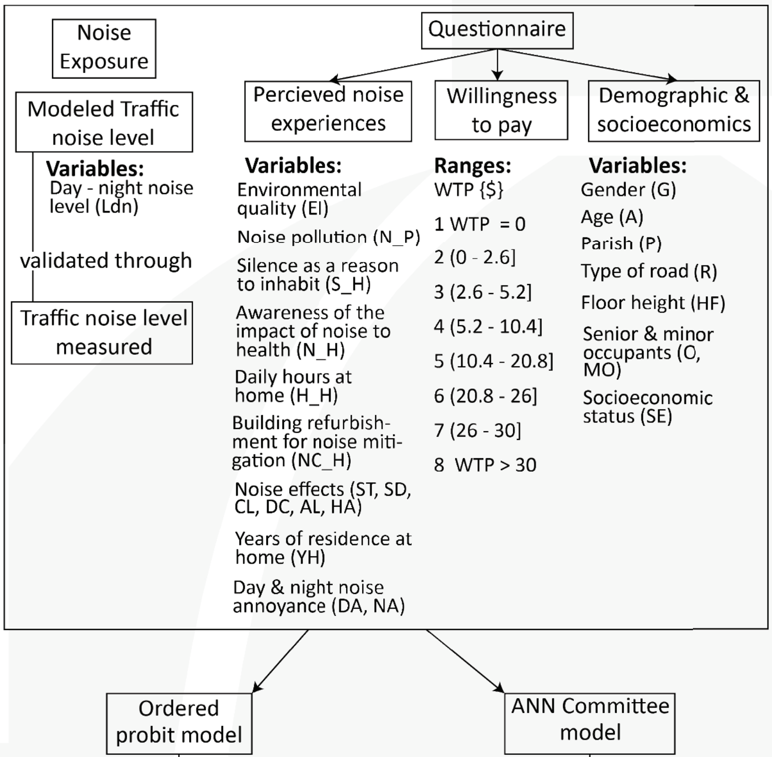
Abstract

This poster presents a new approach to value the willingness to pay to reduce road noise annoyance using an artificial neural network (ANN) ensemble. The model predicts, with adequate precision and accuracy, a willingness to pay range from subjective assessments of noise, a modeled noise exposure level, and both demographic and socio-economic conditions. The results were compared with an ordered probit econometric model in terms of the performance mean relative error, and obtained a 85% better accuracy. The results of this study show that the model reach an adequate generalization level and can be applicable as a tool for valuing noise from transportation in order to obtain financial resources for action plans.

Approach



Method



Var. Lavel	β	Std. Error	Z	sig.
EI	15,255	1,740	8,764	0,000
N_P	0,064	0,277	0,231	0,817
S_H	1,976	0,466	4,240	0,000
N_H	9,125	1,088	8,381	0,000

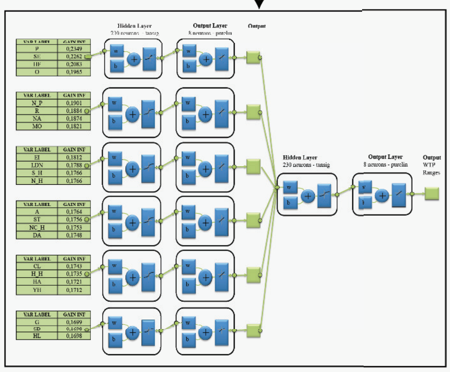
Var. Lavel	β	Std. Error	Z	sig.
YH	-0,040	0,103	-0,394	0,694
H_H	-0,601	0,153	-3,921	0,000
DA	0,817	0,147	5,528	0,000
NA	-0,073	0,125	-0,583	0,559

Var. Lavel	β	Std. Error	Z	sig.
NC_H	5,079	1,272	3,993	0,000
ST	1,600	0,363	4,401	0,000
DC	0,324	0,213	1,518	0,129
SD	1,968	0,355	5,544	0,000

Var. Lavel	β	Std. Error	Z	sig.
AL	2,588	1,390	1,861	0,063
HA	2,782	0,434	6,408	0,000
Ldn	-0,198	0,041	-4,753	0,000
G	2,747	0,456	6,017	0,000

Var. Lavel	β	Std. Error	Z	sig.
A	-2,891	0,779	-3,709	0,0002
P	-1,198	0,299	-4,000	1E-04
R	-3,138	1,276	-2,459	0,0139
O	1,093	0,369	2,957	0,0031

Var. Lavel	β	Std. Error	Z	sig.
MO	2,849	0,433	6,574	0,000
HF	0,786	0,181	4,320	0,000
SE	5,796	0,917	6,319	0,000



Performance comparison

Percentage error values (%) comparison for econometric and ANN models for each range of WTP

Ranges	Econometric Model		ANN Model		
	Estimation	Validation	Training	Validation	Test
	MSE 0.88	MSE 0.87	MSE 0.177	MSE 0.531	MSE 0.461
1	16.28	21.62	13.40	11.40	8.57
2	0.00	100.00	1,52	0.00	0.00
3	8.00	10.00	16.4	2.86	0.00
4	12.20	16.67	9.73	2.86	2.86
5	19.05	16.00	10.00	7.14	12.90
6	10.34	7.69	5.47	4.29	5.71
7	6.67	42.86	4.26	2.86	2.86
8	19.40	17.24	7.29	5.71	4.29
Weighted Average	15.20	18.57	8.69	6.37	2.65

Conclusions

- An alternative approach (not found in the literature) to value traffic noise impacts using an ANN Committee was presented. This committee was trained with contingent valuation survey conducted on Quito Metropolitan District.
- The structure of the committee consists of six neural networks. In all the networks, one hidden layer with 230 neurons was used. The output of each individuals ANN feed a consolidating network that provide the WTP range.
- The variable distribution on the ANN committee was determined by their impact level defined by the gain of information.
- Compared with econometric model, this approach presents a 85% better performance accuracy in terms of average percentage error.